

Golden Eagle (*Aquila chrysaetos*)

Legal Status

State: Fully Protected,
Watch List

Federal: Protected under the
Bald and Golden Eagle
Protection Act and Migratory Bird Treaty Act, U.S. Fish and Wildlife
Service Bird of Conservation Concern

Critical Habitat: N/A

Recovery Planning: N/A

Notes: Listing status not anticipated to change during permit period



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Taxonomy

Of five or six golden eagle (*Aquila chrysaetos*) subspecies throughout the Northern Hemisphere, only one occurs in North America: *Aquila chrysaetos canadensis*. No information is available on geographic or genetic variation within the North American subspecies (Kochert et al. 2002).

Distribution

General

The golden eagle is predominately a western North American species, ranging from northern Alaska through the western states and Great Plains to Mexico, with some breeding and wintering locations in eastern North America (Figure SP-B09). Within California, the golden eagle is a year-round resident generally inhabiting mountainous and hilly terrain throughout the open areas of the state. Descriptions of the species' physical characteristics, behavior, and distribution are provided in a variety of field guides (e.g., Peterson 1990; Sibley 2000; National Geographic 2002).

Distribution and Occurrences within the Plan Area

Historical

The golden eagle is an uncommon permanent resident and migrant throughout the Plan Area, ranging from sea level up to 3,500 meters (11,480 feet) (Grinnell and Miller 1944). Habitat typically includes rolling foothills of oak and juniper woodlands, mountain areas, and desert. Breeding habitat is more prevalent in the southern portion of the Plan Area, including northern Imperial County, Riverside County, and southern San Bernardino County, as well as interspersed in northern San Bernardino County and the more mountainous regions of southern Inyo County (University of Washington 2011). Historically, golden eagles are rare or absent in the lower elevation desert regions of the Plan Area and the vicinity of the Salton Sea and the lower Colorado River (Kochert et al. 2002). There are 327 historical (i.e., prior to 1990) records of occurrence for golden eagle in the Plan Area and an additional 12 occurrences with an unknown observation date (CDFW 2013; Dudek 2013). There are golden eagle historical occurrences throughout the Plan Area, but with concentrations in the west Mojave, the region between Victorville and Barstow east of Interstate 15, the Mojave National Preserve, and the east portion of Joshua Tree National Park (Figure SP-B09).

Recent

There are 625 recent (i.e., since 1990) documented occurrences for golden eagle within the Plan Area (Figure SP-B09) (CDFW 2013; Dudek 2013). Golden eagles have occupied nearly every mountain range in the Plan Area; territory occupancy is variable from year to year, productivity is generally low, and most territories contain several alternate nests (La Pré 2011, pers. comm.). The Bureau of Land Management (BLM) identified “Key Raptor Areas” for golden eagles encompassing the Granite, El Paso, Newberry, and Red mountains, Stoddard Ridge, and Daggett Ridge (Raptor Research Foundation 1989). Other important occupied habitat is in the Clark Mountain Range, Tehachapi Mountains, southern Sierra Nevada Mountains, and Calico Mountains. Golden eagles may be less abundant in southeastern Imperial County (La Pré 2011, pers. comm.) Many

documented occurrences and nests exist to the southwest of the Plan Area in western Riverside and San Diego counties (CDFW 2013).

Natural History

Habitat Requirements

Golden eagles use nearly all terrestrial habitats of the western states, occurring primarily in mountainous canyon land, rimrock terrain of open desert and grassland areas (Kochert et al. 2002) (Table 1). In central California, they prefer open grasslands and oak savanna, with lesser numbers in oak woodland and open shrublands (Hunt et al. 1998) but can also be found in desert grasslands and chaparral habitats (Millsap 1981). Cliffs and large trees are used for nesting. Eagles favor cliff ledges with overhangs in areas where extreme solar radiation or high rates of precipitation threaten chick survival (Hunt, pers. comm. 2012). Preferred territory sites include those that have a favorable nest site, a dependable food supply, and broad expanses of open country for foraging (see Foraging Requirements). Hilly or mountainous country where takeoff and soaring are supported by updrafts is generally preferred to flat habitats (Johnsgard 1990). Deeply cut canyons rising to open mountain slopes and crags are ideal habitat (Kochert et al. 2002). Extensive croplands are generally avoided (Hunt, pers. comm. 2012). Golden eagles nest from 200 feet to over 9,000 feet above mean sea level (AMSL).

Table 1. Habitat Associations for Golden Eagle

Land Cover Type	Land Cover Use	Habitat Designation	Habitat Parameters	Supporting Information
Other (rock outcrops/barrens)	Nesting	Primary habitat	Rugged, open habitats with canyons and escarpments; secluded cliff faces with ledges extensive enough to accommodate large stick nests. Overhanging ledges preferable in extremely hot or very rainy environments.	Direct observations

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Land Cover Type	Land Cover Use	Habitat Designation	Habitat Parameters	Supporting Information
Upland tree-dominated conifer	Nesting/roosting, cover	Primary habitat	Large trees, near suitable ground squirrel and other prey habitat; trees large enough to support the large nest structure (up to 3 meters across and 1 meter deep)	Direct observations and radiotelemetry studies
Grasslands	Foraging	Secondary habitat	Relatively open and expansive rolling foothills and mountain terrain, often with wide plateaus cut by streams or canyons on open mountain slopes	Direct observations and radiotelemetry studies, and aerial surveys

Sources: Kochert et al. 2002, Hunt, pers. comm. 2012
m – meter

Foraging Requirements

Golden eagles typically forage in open habitats including grasslands and shrublands. They feed mainly on leporids (hares and rabbits) and sciurids (ground squirrels, prairie dogs, marmots), but they also take birds, fish, and reptiles, and frequently feed on carrion (Kochert et al. 2002). Hunting strategies are variable and include attack glides from soaring flight, low-level glides over open hilly terrain (“contour hunting”), and attacks from a perch (Kochert et al. 2002; Polite and Pratt 1990). Golden eagles often pirate food from other raptors. Hunting in mated pairs is also documented (Kochert et al. 2002).

Reproduction

Golden eagles attain adult plumage in their fifth summer (Kochert et al. 2002). In healthy populations, many adults are prevented from obtaining a breeding territory until a vacancy arises through the death

of an established pair member (Haller 1996). These unmated adults (“floaters”) form a reserve of potential breeders that buffer the breeding population against loss (Hunt 1998). High mortality, particularly among the older age categories, may reduce or eliminate the floater buffer and cause the overall population to decline.

Mated pairs may use the same nest each year, or use alternate nests within their territories (Terres 1991). Pairs rarely re-nest when the first clutch is destroyed (Watson 1997) and there are no records of pairs producing more than one brood per year. Golden eagles prefer to locate their nests on cliffs or in trees near forest edges or in small stands near open fields (Bruce et al. 1982; Hunt et al. 1998). Breeding densities are directly related to territorial spacing and foraging requirements for the species. The breeding cycle extends from late January through August, with peak activity from February through June. Eggs are laid from early February to mid-May (February and March in most of California). Clutch size varies from one to four eggs, but two is the most common size (Brown 1976; Johnsgard 1990). Incubation lasts 43–45 days (Kochert et al. 2002), and the fledging period is 72–84 days (Johnsgard 1990). The young usually remain dependent on their parents for as long as eleven weeks after fledging. Long-term annual reproductive success (number of large young per occupied territory) ranges from 0.64 to 1.08 fledglings per pair in the continental United States, varying with prey abundance and weather (Phillips et al. 1990; Thompson et al. 1982).

Table 2. Key Seasonal Periods for Golden Eagle

	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Breeding	✓	✓	✓	✓	✓	✓	✓	✓				
Migration		✓	✓	✓					✓	✓	✓	✓

Notes: Active year-round residents in Southern California.

Sources: Polite and Pratt 1990; Kochert et al. 2002

Activity and Movement

Golden eagles in the Plan Area are mostly resident (Polite and Pratt 1990). Dixon (1937) estimated an average home range size of about 93 kilometers² (36 miles²) in Southern California, but home range can vary substantially with habitat conditions and prey availability. In the western U.S., on average, eagles forage over home ranges ranging from about 22 to 33 kilometers² (8.5 to 12.7 miles²) during the breeding season (Kochert et al. 2002). Resident pairs maintain home ranges year-round with shifts in intensity of use from the breeding season to winter (Dunstan et al. 1978; Marzluff et al. 1997). Both residents and migratory individuals show fidelity to wintering areas (Kochert et al. 2002). Though limited dispersal data exist, three radio tagged resident breeders in California all moved to new territories within 8 kilometers after leaving their original ones (Kochert et al. 2002). Some migrants may temporarily move into areas used by resident birds during the winter.

Table 3. Spatial Behavior of the Golden Eagle

Type	Distance/Area	Location of Study	Citation
Territory	93 km ²	Southern California	Dixon 1937
Distance between active nest sites	>0.8 km	Western United States	Palmer 1988
Dispersal from natal site	Ranged from 6.7 to 64.7 km	Idaho	Steenhof et al. 1984
> – greater than km – kilometer			

Ecological Relationships

Golden eagles are a top avian predator in the scrubland, grassland, and woodland ecosystems that make up much of the Plan Area. They may directly compete with ferruginous hawks (*Buteo regalis*) and other hawks for mammal prey, and with California condors (*Gymnogyps californianus*), turkey vultures (*Cathartes aura*) and ravens (*Corvus corax*) for carrion. Territorial interactions with other golden eagles may result in some fatalities.

Population Status and Trends

Global: Secure (NatureServe 2011)

State: Vulnerable (NatureServe 2011)

Within Plan Area: Apparently stable (Remsen 1978)

The golden eagle is relatively common in some areas of its range. Local threats or declines do not currently pose a major conservation problem from a global perspective (NatureServe 2011). This species was once a common resident throughout the open areas of California. Numbers are now reduced near human population centers; nesting populations in San Diego County decreased from an estimated 85 pairs in 1900 to 40 occupied territories in 1999 due to extensive residential development (Kochert et al. 2002).

Threats and Environmental Stressors

Golden eagle declines, where they have occurred, are attributed primarily to habitat degradation and human-induced disturbances and mortality (Kochert et al. 2002). Golden eagles are particularly sensitive to human activity near nests, especially during incubation and before the young can thermoregulate (at approximately 3 weeks or age). Golden eagles may be secondarily poisoned by consuming prey that has itself been poisoned by chemicals used to protect crops or kill rodents (Kochert et al. 2002). Additional mortality agents are poaching, electrocution from distribution and utility lines, wire strikes, wind turbine strikes, and lead poisoning (Remsen 1978; Thelander 1974). In a study of the causes of fatalities in 61 golden eagles radio-tagged and recovered in the Diablo Range from January 1994 to December 1997, 37% were killed by wind turbine strikes, 16% by electrocution, and 5% by lead poisoning (Hunt et al. 1998); additional poisoning deaths were suspected in undiagnosed fatalities not involving trauma. The pervasiveness of lead in the environment in the remains of gun-killed animals may impact golden eagle populations. Evidence of elevated blood-lead levels (greater than 0.20 parts per million), likely from ingested hunter ammunition, was detected in 36% of 162 eagles from Southern California from 1985 to 1986 (Harlow and Bloom 1989; Pattee et al. 1990). More than 270 eagles were electrocuted in North America during 1986-1996 (Harness and Wilson 2001); ieagles are most susceptible to

electrocution when landing on power poles where parallel wires are close together (Kochert et al. 2002). Vehicle collisions have also been documented as a cause of mortality (Phillips 1986). Studies have documented heat stress as a significant mortality factor for nestlings (Mosher and White 1976), and an inverse correlation exists between nesting success and the number of days with temperatures greater than 32°C (89.6°F) (Steenhof et al. 1997).

Conservation and Management Activities

There are no conservation actions in the Plan Area directed specifically at the golden eagle. However, land preservation in the Southern California desert and surrounding areas by agencies such as the National Park Service, Bureau of Land Management, Department of Defense, and California State Parks have indirectly benefited golden eagles by preserving open space. Management practices on these lands that enhance golden eagles' prey base (e.g., rodents, hares, and rabbits), would likely confer additional benefits. Furthermore, the Bureau of Land Management identifies the golden eagle as a sensitive species within the Plan Area (BLM 2007). Golden eagle management and conservation generally includes habitat management, hazard management, education, and controlling human activity in sensitive raptor areas, especially during the nesting season.

The USFWS released a *Draft Eagle Conservation Guidance* document in January 2011 (USFWS 2011). This document provides guidance for preparation of Eagle Conservation Plans (ECPs) related to wind energy facilities. It would be a voluntary program for project proponents, but they would have to coordinate with the USFWS if a different approach were taken to ensure that alternative approaches would provide comparable data (USFWS 2011). The evaluation of a proposed wind energy project would be conducted in five stages:

1. *Stage 1: Identify potential wind facility locations with manageable risk to eagles at the landscape level.*
2. *Stage 2: Obtain site-specific data to predict eagle fatality rates and disturbance take at wind facility sites that pass Stage 1 assessment.*

3. *Conduct turbine-based risk assessment and estimate the fatality rate of eagles for the facility evaluated in Stage 2, excluding possible advanced conservation practices (ACPs).*
4. *Identify and evaluate ACPs that might avoid or minimize fatalities identified in Stage 3. When required to do so, identify compensatory mitigation necessary to reduce any remaining fatality effect to a no-net-loss standard.*
5. *Document annual eagle fatality rate and disturbance effects. Identify additional ACPs to reduce observed level of mortality, and determine if initial ACPs are working and should be continued. When appropriate, monitor effectiveness of compensatory mitigation.*

(USFWS 2011, p. 6).

At the end of each of the first four stages, the project proponent would determine which of the following categories the project, as planned, would fall into: (1) high risk to eagles, little opportunity to minimize effects; (2) high to moderate risk to eagles, but with an opportunity to minimize effects; (3) minimal risk to eagles; or (4) uncertain. The USFWS recommends that projects that fall into category 1 be moved, significantly redesigned, or abandoned because they likely would not meet the regulatory requirement for an ECP and permit issuance. Projects that fall into categories 2, 3, and 4 would be candidates for an ECP and permit (USFWS 2011).

The Draft Eagle Conservation Guidance is currently under review and has not been formally adopted by the USFWS.

Data Characterization

Several regional surveys in portions of the Plan Area for golden eagle have been conducted by the Wildlife Research Institute, Inc. (WRI), including an area of approximately 4,142 kilometers² (1,600 miles²) in the eastern Mojave Desert in San Bernardino and Riverside counties (WRI 2010), in the western Mojave Desert (WRI 2002), on BLM Open Areas in the Johnson and Stoddard valleys (WRI 2003, 2009a), and in Anza Borrego State Park (WRI 2009b). These studies have collected data for golden eagle nests and alternative nests, including appraisals

of nest condition, whether active or not, nest elevation, GPS coordinates, nest substrate (cliff, transmission tower, etc.), breeder age class, and behavior (e.g., WRI 2010). In addition, annual nesting surveys in San Diego County have been conducted since 1988, including the desert regions of eastern San Diego County (Unitt 2004). In other areas of California, extensive long-term studies have been conducted in the central coast ranges of California on the distribution, demographics, and general biology of golden eagles as part of investigations on the impact of wind turbine operation on this species (Hunt et al. 1998). These studies provide detailed information on the distribution and habitat-use patterns of resident and nonresident golden eagles, population structure, reproductive rates, survival rates, and population equilibrium dynamics in the central coast ranges of California. Some additional literature, some of which pertains to Southern California, is available for the golden eagle because it is a highly visible, fully protected bird of prey and a top avian predator within its range. Most of the literature pertains to general natural history, behavior, distribution, and population changes in the past 30 to 40 years. Some information is available on demographics and population trends. Limited species-specific management information is available.

Management and Monitoring Considerations

Management of healthy eagle populations includes maintaining prey habitat in foraging areas by maintaining native grassland, shrub, or woodland communities depending on foraging and nesting relationships (Marzluff et al. 1997; Kochert et al. 1999), protecting foraging habitat within 3 kilometers (1.9 miles) of nests from human disturbance and fire, and restoring shrubs in burned areas (Kochert et al. 1999). Fires have caused large-scale losses of shrubs and degraded prey (e.g., rabbit) habitat in areas used by eagles throughout California. Thus recovery of these areas as foraging habitat is important.

As discussed above under Threats and Environmental Stressors, human activities near nests can cause nest failure and nest abandonment. Planned activities in the Plan Area should consider what management actions and monitoring considerations are required to avoid and minimize human impacts to nest sites, including seasonal restrictions on certain activities near active nests and

protective buffer zones (both spatial and visual) around active nest sites. Monitoring of nest sites in areas where human activities are occurring would help distinguish between relatively benign activities that are tolerated by golden eagles and activities that disturb birds.

Another important consideration for management and monitoring of golden eagle populations is ensuring that eagles have access to safe food sources. Agricultural activities, for example, may affect golden eagles through contamination of prey by chemicals used to protect crops, including phorate, carbofuran, strychnine, and anticoagulant rodenticides (Kochert et al. 2002).

Other human-caused sources of mortality for golden eagles that may warrant monitoring and management and/or design specifications to minimize threats include wind turbine and vehicle collisions (Hunt et al. 1998; Phillips 1986) and electrocutions from power lines (Harness and Wilson 2001). Utility companies such as Southern California Edison incorporate anti-perching and anti-collision guidelines in design of transmission line facilities consistent with the Avian Power Line Interaction Committee (APLIC 2006).

As discussed above, the USFWS recently released the Draft Eagle Conservation Guidance for public review (USFWS 2011). The Stage 5 objective is annual monitoring of eagle mortality and disturbance effects, the effectiveness of compensatory mitigation, and identification of additional advanced conservation practices (ACPs) to reduce mortality and other adverse effects (USFWS 2011).

Development of a population monitoring strategy should be a priority, especially in the western United States where population declines are suspected (Kochert et al. 2002)

Species Modeled Habitat Distribution

This section provides the results of habitat modeling for golden eagle, using available spatial information and occurrence information, as appropriate. For this reason, the term “modeled suitable habitat” is used in this section to distinguish modeled habitat from the habitat information provided in Habitat Requirements, which may include additional habitat and/or microhabitat factors that are important for

species occupation, but for which information is not available for habitat modeling.

There are 11,219,198 acres of modeled suitable habitat for golden eagle in the Plan Area. Appendix C includes a figure showing the modeled suitable habitat in the Plan Area.

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